

WHAT IS CLAIMED IS:

1. A method for reducing transmit power in a mobile device in a network comprising:

detecting control information from a network node during a control channel sub-frame intended for a mobile device;

transmitting a negative acknowledge signal in a slot allocated to feedback information in a uplink channel sub-frame immediately preceding a uplink channel sub-frame defined for an acknowledge (ACK) signal or a negative acknowledge (NAK) signal transmission for downlink channel data associated with said control information if no ACK signal or NACK signal was transmitted in a slot allocated to feedback information in a uplink channel sub-frame as a result of a feedback information process from a control channel sub-frame preceding said control channel sub-frame;

receiving said downlink channel data indicated by the control information at the mobile device and transmitting an ACK signal or NACK signal in accordance with appropriate receipt of said downlink channel data; and

determining if control information intended for the mobile device is detected in a next valid control channel sub-frame following a sub-frame in which control information intended for the mobile device was detected, and if not, transmitting a NACK signal in a slot allocated to feedback information in a uplink channel sub-frame corresponding to the next valid control channel sub-frame.

2. The method according to claim 1, wherein the control channel comprises a high-speed shared control channel (HS-SCCH).

3. The method according to claim 1, wherein the feedback information comprises a hybrid automatic repeat request (HARQ-ACK).
4. The method according to claim 1, wherein the uplink channel comprises a high-speed dedicated physical control channel (HS-DPCCH).
5. The method according to claim 1, wherein the downlink channel comprises a high-speed downlink shared channel (HS-DSCH).
6. The method according to claim 1, further comprising determining if a specific situation exists and if so, determining if control information intended for the mobile device is detected in a next valid control channel sub-frame, and if not, transmitting a NACK signal in a slot allocated to feedback information in a uplink channel sub-frame corresponding to the next valid control channel sub-frame.
7. The method according to claim 6, wherein the specific situation comprises at least one of the mobile device being in a soft handover situation having more than one radio link allocated, a maximum power being reached, SSDT signaling indicating HSDPA serving cell being non-primary, detecting channel quality indication (CQI) for a worst possible data rate/offset, a mismatch over a certain period between power control decisions in soft handover area (SHO) and power control commands from a high-speed downlink packet access (HSDPA) serving cell.

8. The method according to claim 1, wherein said slot comprises a Transmission Time Interval (TTI).
9. The method according to claim 1, wherein the mobile device is a mobile phone.
10. The method according to claim 1, wherein the network node comprises one of a Radio Resource Controller (RRC) and a Base Station Controller (BSC).
11. The method according to claim 1, wherein a DTX_MODE signal equals one.
12. The method according to claim 1, wherein an N_ACKNACK_TRANSMIT value equals one.
13. The method according to claim 1, wherein the network comprises a Radio Access Network (RAN).
14. The method according to claim 1, wherein the network node avoids having to detect continuous DTX transmissions in a HARQ-ACK sub-frame, allowing a reduction in a required ACK transmission power at the mobile device.
15. The method according to claim 1, further comprising instructing the mobile device by the network node whether to perform the transmitting step and the

determining step.

16. The method according to claim 15, further comprising instructing the mobile device by the network node to perform the transmitting step and the determining step when the mobile device is in a soft handover area.

17. A method for reducing transmit power in a mobile device in a network comprising:

detecting control information from a network node intended for a mobile device during a control channel sub-frame;

determining if an $N_acknack_transmit$ value > 1 , and if so, transmitting a negative acknowledge signal (NACK) in two slots allocated to feedback information in two preceding uplink channel sub-frames immediately preceding a uplink channel sub-frame defined for an acknowledgement transmission for downlink channel data associated with the control information if no acknowledgement transmission occurred in slots as a result of a feedback information process from a preceding control channel sub-frame immediately preceding said control channel sub-frame or a control channel sub-frame preceding said preceding control channel sub-frame;

receiving said downlink channel data indicated by the control information at the mobile device and transmitting an ACK signal or NACK signal in accordance with appropriate receipt of said downlink channel data; and

determining if control information intended for the mobile device is detected in a next valid control channel sub-frame following a sub-frame in which control information intended for the mobile device was detected, and if not, transmitting a

NACK in a slot allocated to feedback information in each of $N_{\text{acknack_transmit}}$ sub-frames starting in the uplink channel sub-frame corresponding to the next valid control channel sub-frame.

18. The method according to claim 17, wherein the control channel comprises a high-speed shared control channel (HS-SCCH).

19. The method according to claim 17, wherein the feedback information comprises a hybrid automatic repeat request (HARQ-ACK).

20. The method according to claim 17, wherein the uplink channel comprises a high-speed dedicated physical control channel (HS-DPCCH).

21. The method according to claim 17, wherein the downlink channel comprises a high-speed downlink shared channel (HS-DSCH).

22. The method according to claim 17, further comprising determining if a specific situation exists and if so determining if a DTX mode signal =1, and if so, determining if control information intended for the mobile device is detected in a next valid control channel sub-frame following a sub-frame in which control information intended for the mobile device was detected, and if so, transmitting a NACK in a slot allocated to feedback information in each of $N_{\text{acknack_transmit}}$ sub-frames starting in the uplink channel sub-frame corresponding to the next valid control channel sub-frame.

23. The method according to claim 22, wherein the specific situation comprises at least one of the mobile device being in a soft handover situation having more than one radio link allocated, a maximum power being reached, SSDT signaling indicating HSDPA serving cell being non-primary, detecting CQI for a worst possible data rate/offset, and a mismatch over a certain period between power control decisions in SHO and power control commands from the HSDPA serving cell.

24. The method according to claim 17, wherein said slot comprises a Transmission Time Interval (TTI).

25. The method according to claim 17, wherein the mobile device is a mobile phone.

26. The method according to claim 17, wherein the network node comprises one of a Radio Resource Controller (RRC) and a Base Station Controller (BSC).

27. The method according to claim 17, wherein a DTX_MODE signal equals one.

28. The method according to claim 17, wherein the network comprises a Radio Access Network (RAN).

29. The method according to claim 17, wherein the network node avoids

having to detect continuous DTX transmissions in a HARQ-ACK sub-frame, allowing a reduction in a required ACK transmission power at the mobile device.

30. The method according to claim 17, further comprising instructing the mobile device by the network node whether to perform the transmitting step and the determining step.

31. The method according to claim 30, further comprising instructing the mobile device by the network node to perform the transmitting step and the determining step when the mobile device is in a soft handover area.

32. A system for reducing transmit power in a mobile device in a network comprising:

a network node, the network device operatively connected to the network and sending control information in sub-frames of a control channel and associated data in sub-frames of a downlink channel to at least one mobile device; and

a mobile device, the mobile device operatively connected to the network and detecting control information during a control channel sub-frame intended for the mobile device and performing:

transmitting to the network node a negative acknowledge signal in a slot allocated to feedback information in a uplink channel sub-frame immediately preceding a uplink channel sub-frame defined for an acknowledge (ACK) signal or a negative acknowledge (NAK) signal transmission for downlink channel data associated with said control information if no ACK signal or NACK signal was

transmitted in a slot allocated to feedback information in a uplink channel sub-frame as a result of a feedback information process from a control channel sub-frame preceding said control channel sub-frame;

receiving said downlink channel data indicated by the control information at the mobile device and transmitting an ACK signal or NACK signal in accordance with appropriate receipt of said downlink channel data to the network node; and

determining if control information intended for the mobile device is detected in a next valid control channel sub-frame following a sub-frame in which control information intended for the mobile device was detected, and if not, transmitting a NACK signal to the network node in a slot allocated to feedback information in a uplink channel sub-frame corresponding to the next valid control channel sub-frame.

33. The system according to claim 32, wherein the control channel comprises a high-speed shared control channel (HS-SCCH).

34. The system according to claim 32, wherein the feedback information comprises a hybrid automatic repeat request (HARQ-ACK).

35. The system according to claim 32, wherein the uplink channel comprises a high-speed dedicated physical control channel (HS-DPCCH).

36. The system according to claim 32, wherein the downlink channel

comprises a high-speed downlink shared channel (HS-DSCH).

37. A system for reducing transmit power in a mobile device in a network comprising:

a network node, the network device operatively connected to the network and sending control information in sub-frames of a control channel and associated data in sub-frames of a downlink channel to at least one mobile device; and

a mobile device, the mobile device operatively connected to the network and detecting control information from a network node intended for a mobile device during a control channel sub-frame and performing:

determining if an $N_acknack_transmit$ value > 1 , and if so, transmitting a negative acknowledge signal (NACK) in two slots allocated to feedback information in two preceding uplink channel sub-frames immediately preceding a uplink channel sub-frame defined for an acknowledgement transmission for downlink channel data associated with the control information if no acknowledgement transmission occurred in slots as a result of a feedback information process from a preceding control channel sub-frame immediately preceding said control channel sub-frame or a control channel sub-frame preceding said preceding control channel sub-frame;

receiving said downlink channel data indicated by the control information at the mobile device and transmitting an ACK signal or NACK signal in accordance with appropriate receipt of said downlink channel data; and

determining if control information intended for the mobile device is detected in a next valid control channel sub-frame following a sub-frame in which control information intended for the mobile device was detected, and if not,

transmitting a NACK in a slot allocated to feedback information in each of
N_acknack_transmit sub-frames starting in the uplink channel sub-frame
corresponding to the next valid control channel sub-frame.

38. The system according to claim 37, wherein the control channel comprises
a high-speed shared control channel (HS-SCCH).

39. The system according to claim 37, wherein the feedback information
comprises a hybrid automatic repeat request (HARQ-ACK).

40. The system according to claim 37, wherein the uplink channel comprises
a high-speed dedicated physical control channel (HS-DPCCH).

41. The system according to claim 37, wherein the downlink channel
comprises a high-speed downlink shared channel (HS-DSCH).

42. A mobile device containing a storage medium with instructions stored
therein, the instructions when executed causing the mobile device to perform:

detecting control information from a network node during a control channel
sub-frame intended for the mobile device;

transmitting a negative acknowledge signal in a slot allocated to feedback
information in a uplink channel sub-frame immediately preceding a uplink channel
sub-frame defined for an acknowledge (ACK) signal or a negative acknowledge
(NAK) signal transmission for downlink channel data associated with said control

information if no ACK signal or NACK signal was transmitted in a slot allocated to feedback information in a uplink channel sub-frame as a result of a feedback information process from a control channel sub-frame preceding said control channel sub-frame;

receiving said downlink channel data indicated by the control information at the mobile device and transmitting an ACK signal or NACK signal in accordance with appropriate receipt of said downlink channel data; and

determining if control information intended for the mobile device is detected in a next valid control channel sub-frame following a sub-frame in which control information intended for the mobile device was detected, and if not, transmitting a NACK signal in a slot allocated to feedback information in a uplink channel sub-frame corresponding to the next valid control channel sub-frame.

43. The mobile device according to claim 42, wherein the control channel comprises a high-speed shared control channel (HS-SCCH).

44. The mobile device according to claim 42, wherein the feedback information comprises a hybrid automatic repeat request (HARQ-ACK).

45. The mobile device according to claim 42, wherein the uplink channel comprises a high-speed dedicated physical control channel (HS-DPCCH).

46. The mobile device according to claim 42, wherein the downlink channel comprises a high-speed downlink shared channel (HS-DSCH).

47. The mobile device according to claim 42, wherein the mobile device is a mobile phone.

48. A mobile device containing a storage medium with instructions stored therein, the instructions when executed causing the mobile device to perform:

detecting control information from a network node intended for the mobile device during a control channel sub-frame;

determining if an $N_acknack_transmit$ value > 1 , and if so, transmitting a negative acknowledge signal (NACK) in two slots allocated to feedback information in two preceding uplink channel sub-frames immediately preceding a uplink channel sub-frame defined for an acknowledgement transmission for downlink channel data associated with the control information if no acknowledgement transmission occurred in slots as a result of a feedback information process from a preceding control channel sub-frame immediately preceding said control channel sub-frame or a control channel sub-frame preceding said preceding control channel sub-frame;

receiving said downlink channel data indicated by the control information at the mobile device and transmitting an ACK signal or NACK signal in accordance with appropriate receipt of said downlink channel data; and

determining if control information intended for the mobile device is detected in a next valid control channel sub-frame following a sub-frame in which control information intended for the mobile device was detected, and if not, transmitting a NACK in a slot allocated to feedback information in each of $N_acknack_transmit$ sub-frames starting in the uplink channel sub-frame corresponding to the next valid

control channel sub-frame.

49. The mobile device according to claim 48, wherein the control channel comprises a high-speed shared control channel (HS-SCCH).

50. The mobile device according to claim 48, wherein the feedback information comprises a hybrid automatic repeat request (HARQ-ACK).

51. The mobile device according to claim 48, wherein the uplink channel comprises a high-speed dedicated physical control channel (HS-DPCCH).

52. The mobile device according to claim 48, wherein the downlink channel comprises a high-speed downlink shared channel (HS-DSCH).

53. The mobile device according to claim 48, wherein the mobile device is a mobile phone.

54. A network node containing a storage medium with instructions stored therein, the instructions when executed causing the network node to perform:

sending control information to a mobile device during a control channel sub-frame intended for the mobile device;

receiving a negative acknowledge signal from the mobile device in a slot allocated to feedback information in a uplink channel sub-frame immediately preceding a uplink channel sub-frame defined for an acknowledge (ACK) signal or a

negative acknowledge (NAK) signal reception for downlink channel data associated with said control information;

transmitting said downlink channel data indicated by the control information to the mobile device and receiving an ACK signal or NACK signal in accordance with appropriate receipt of said downlink channel data by said mobile device; and

receiving a NACK signal from the mobile device in a slot allocated to feedback information in a uplink channel sub-frame corresponding to a next valid control channel sub-frame, if the mobile device determines that control information intended for the mobile device is not detected in the next valid control channel sub-frame following a sub-frame in which control information intended for the mobile device was detected.

55. The network node according to claim 54, wherein the control channel comprises a high-speed shared control channel (HS-SCCH).

56. The network node according to claim 54, wherein the feedback information comprises a hybrid automatic repeat request (HARQ-ACK).

57. The network node according to claim 54, wherein the uplink channel comprises a high-speed dedicated physical control channel (HS-DPCCH).

58. The network node according to claim 54, wherein the downlink channel comprises a high-speed downlink shared channel (HS-DSCH).

59. The network node according to claim 54, wherein the network node comprises one of a Radio Resource Controller (RRC) and a Base Station Controller (BSC).

60. The network node according to claim 54, wherein the mobile device is a mobile phone.

61. A network node containing a storage medium with instructions stored therein, the instructions when executed causing the network node to perform:

sending control information intended for a mobile device during a control channel sub-frame;

receiving a negative acknowledge signal (NACK) from the mobile device in two slots allocated to feedback information in two preceding uplink channel sub-frames immediately preceding a uplink channel sub-frame defined for an acknowledgement reception for downlink channel data associated with the control information if no acknowledgement reception occurred in slots as a result of a feedback information process from a preceding control channel sub-frame immediately preceding said control channel sub-frame or a control channel sub-frame preceding said preceding control channel sub-frame and if an $N_acknack_transmit$ value > 1 ;

transmitting the downlink channel data indicated by the control information to the mobile device and receiving an ACK signal or NACK signal in accordance with appropriate receipt of the downlink channel data by the mobile device; and

receiving a NACK from the mobile device in a slot allocated to feedback

information in each of N_acknack_transmit sub-frames starting in the uplink channel sub-frame corresponding to a next valid control channel sub-frame if the mobile device determined that control information intended for the mobile device was not detected in a next valid control channel sub-frame following a sub-frame in which control information intended for the mobile device was detected.

62. The network node according to claim 61, wherein the control channel comprises a high-speed shared control channel (HS-SCCH).

63. The network node according to claim 61, wherein the feedback information comprises a hybrid automatic repeat request (HARQ-ACK).

64. The network node according to claim 61, wherein the uplink channel comprises a high-speed dedicated physical control channel (HS-DPCCH).

65. The network node according to claim 61, wherein the downlink channel comprises a high-speed downlink shared channel (HS-DSCH).

66. The network node according to claim 61, wherein the mobile device is a mobile phone.

67. The network node according to claim 61, wherein the network node comprises one of a Radio Resource Controller (RRC) and a Base Station Controller (BSC).